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# Screening Cotton for Resistance to Pink Bollworm

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## ABSTRACT

Cultivars, breeding stocks, and primitive race stocks of cotton, *Gossypium hirsutum* L. and *G. barbadense* L., were screened in the laboratory, greenhouse, and field for natural resistance to pink bollworm (PBW), *Pectinophora gossypiella* (Saunders).

Upland (*G. hirsutum*) cottons that have shown resistance include nectariless, Okra-leaf, Super Okra-leaf, glabrous, Pilose (densely pubescent), high-terpenoid (gossypol), and early maturing types. Other upland cottons showing resistance were an obsolete American cultivar 'Coker's Foster 300', an Indian cultivar 'Laxmi', and four breeding stocks of complex parentage from Texas (AET-5, AET-Br-2-1, and AET-Br-2-8) and Arizona (7203-14-104).

American Pima (*G. barbadense*) breeding stocks showing resistance were Pilose, Okra-leaf, glandless, and Pima dwarf.

A number of *G. hirsutum* primitive race stocks showed PBW resistance. The most promising ones were Texas 39 and Texas 167 because they had a day-neutral flowering habit and were otherwise closely related to the upland cottons.

KEYWORDS: *Gossypium hirsutum*, *Gossypium barbadense*, *Pectinophora gossypiella*, insect resistance, cultivars, breeding stocks, race stocks, cotton.

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## SCREENING COTTON FOR RESISTANCE TO PINK BOLLWORM

F. D. Wilson, B. W. George, and R. L. Wilson<sup>1</sup>

### INTRODUCTION

In 1971, we initiated a breeding program for natural resistance in cotton, *Gossypium hirsutum* L. and *G. barbadense* L., to pink bollworm (PBW), *Pectinophora gossypiella* (Saunders). We have screened many cultivars, breeding stocks, and primitive race stocks in the laboratory, greenhouse, and field. Some of our results have been published previously (1, 3, 4, 6, 7, 8, 9, 10, 11),<sup>2</sup> but in this review we draw together all of our screening data so that they will be accessible in one source.

### MATERIALS AND METHODS

From 1971 to 1979, we carried out three types of screening trials as follows: (a) diet bioassays, in which pink bollworm larvae were reared on an artificial wheatgerm diet to which specified amounts of carpel-wall or boll-content material had been added (4); (b) field tests, in which cotton plants in replicated plots in Arizona and Puerto Rico were exposed to natural populations of PBW (1, 5, 6, 7, 8, 10, 11) and the seed were X-rayed (5) to obtain estimates of damage done by the insect; and (c) greenhouse and field tests where PBW eggs or larvae were placed on green bolls and their development was followed (2; B. W. George and F. D. Wilson, unpublished).

### RESULTS AND DISCUSSION

Forty-five of the 127 upland breeding stocks and cultivars screened in the field in Arizona had significantly less seed damage caused by PBW than did the Deltapine or Stoneville check cultivars (appendix table 1). Eighteen were early maturing and, thus, probably escaped some damage. Most of the rest carried one or more of the following characters which are associated with resistance: nectariless, Okra-leaf, Super Okra-leaf, glabrous (Smooth leaf), Pilose (densely pubescent), or high-terpenoid (gossypol) content. Several upland stocks that carry no obvious mutant characters also showed field resistance, as follows: 'Coker's Foster 300' (an obsolete American

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<sup>2</sup>Italic numbers in parentheses refer to Literature Cited, p. 3.

cultivar), 'Laxmi' (an Indian cultivar), and four stocks of complex parentage from Texas (AET-5, AET-Br-2-1, and AET-Br-2-8) and Arizona (7203-14-104).

AET-5 has consistently shown resistance to PBW. Seed damage in AET-5 has been 18 to 50 percent lower than in the check cultivars (8; F. D. Wilson and B. W. George, unpublished). The major mechanism of resistance in this stock seems to be antixenosis (nonpreference) for oviposition (B. W. George and F. D. Wilson, unpublished). The nectariless cottons have also shown resistance consistently in large (0.5 to 16.2 ha) plots, but not in small plots where the PBW moth can move freely from nectaried to nectariless plants.

Sixty of the 321 primitive race stocks (Texas race stocks) of *G. hirsutum* showed some resistance in diet bioassays and 41 of 290 showed resistance in field plots in Puerto Rico although the reaction of the latter was not necessarily consistent from year to year (table 2).

Seven of 41 race stocks evaluated in the field in Arizona showed some resistance, but in no instance was the resistance reaction consistent when the race stock was tested more than one season (table 3).

Correlation was low between resistance in the diet bioassays and in the field plots as might have been expected because these tests may have measured different facets of resistance. Eight race stocks showed some resistance in both the diet bioassays and in the field in Puerto Rico (T-55, T-65, T-181, T-245, T-316, T-668, T-763, and T-1180), three showed resistance in both the bioassays and in the field in Arizona (T-31, T-39, and T-55), and two stocks showed resistance at both field locations (T-17 and T-55).

A majority of the race stocks that had shown antibiosis in the diet bioassays also showed antibiosis when bolls on greenhouse-grown plants were hand-infested with neonate PBW larvae (table 4). Three of the seven race stocks selected as most promising from the greenhouse tests (T-39, T-167, and T-705) showed antibiosis when PBW eggs were placed on green bolls in the field in Arizona (B. W. George and F. D. Wilson, unpublished).

Six of 36 *G. barbadense* breeding stocks and cultivars showed resistance in field tests in Arizona. The stock that showed the most consistent reaction was Pima glandless, which had significantly lower seed damage than the Pima check cultivar 4 of 5 years in which it was tested (table 5).

None of the cultivars, breeding stocks, or race stocks carrying one resistance character are resistant enough to eliminate the need for insecticide to control PBW. In fact, a theoretical study suggested that at least three resistance characters must be combined in a single cultivar to eliminate that need (3). Therefore, a major objective of our breeding program is to develop breeding stocks that carry enough resistance characters to enable them to produce a satisfactory crop when insecticides are not applied.



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# APPENDIX TABLES

Table 1.--Upland cotton (*G. hirsutum*) cultivars and breeding stocks evaluated for field resistance to pink bollworm, Tempe and Phoenix, Ariz., 1974-79

Cotton	Source	Year(s) tested	Reaction <sup>1</sup>
Auburn 623 RNR	R.L. Shepherd, Ala.	1975	X
6608-27	W.D. Fisher, Ariz.	1975	X
Arizona Super Okra-leaf	--do--	1976-79	R,X,R,R
W-1405 Smooth, nectariless	F.D. Wilson, Ariz.	1976	R
W-1404-6 HG	--do--	1977	R
320F	Ind.Agr.Res.Inst.India	1974,1975	S,X
Stoneville 7A Smooth	J.E. Jones, La.	1975,1976	X,R
La 15213 Smooth, nectariless.	--do--	1975	R
La 21198 Smooth, nectariless, Okra-leaf.	--do--	1976	R
Stoneville 7A Okra-leaf	--do--	1976,1977,1979	R,X,R
La Super-Okra-leaf	--do--	1976	R
Atrophied bract	--do--	1976	X
La 17801 Smooth, nectariless.	--do--	1976,1977	R,R
Stoneville 7A Frego-bract	--do--	1977	X
Stoneville 213 Frego-bract	--do--	1977	X
La 71-7 Normal-Normal-Hairy	--do--	1978,1979	X,X
La 71-7 Normal-Normal-Smooth	--do--	1978,1979	X,S
La 71-7 Normal-Frego-Hairy	--do--	1978,1979	S,X
La 71-7 Normal-Frego-Smooth	--do--	1978,1979	S,X
La 71-7 Okra-Normal-Hairy	--do--	1978,1979	X,X
La 71-7 Okra-Normal-Smooth	--do--	1978,1979	X,X
La 71-7 Okra-Frego-Hairy	--do--	1978,1979	X,X
La 71-7 Okra-Frego-Smooth	--do--	1978,1979	X,X
MU 8B Pubescent, SA-166	R.R. Bridge, Miss.	1974,1975	S,X
DES 24	--do--	1975,1979	X,X
DES 56 (Early) <sup>2</sup>	--do--	1975,1976,1979	R,X,X
Deltatype Webber, SA-395	--do--	1976	X
Coker's Foster 300, SA-259	--do--	1976	R
Deltapine 16 (check)	E.C. Ewing, Jr., Miss.	1974-79	X,X,X,X,X,X
Deltapine 61 (check)	--do--	1975-79	X,X,X,X
Deltapine 7146N (nectariless)	--do--	1977	R
Stoneville 7A	C.W. Manning, Miss.	1974-79	X,X,X,X,X,X
Stoneville 213	--do--	1974-79	X,X,X,X,X,X
Stoneville 256	--do--	1975-79	X,X,X,X,X
Stoneville 731N (nectariless)	--do--	1976,1977	X,R
Stoneville 825N (nectariless)	--do--	1977,1979	R,X
Empire M-11 glandless	W.R. Meredith,Jr. Miss.	1976	X
Stoneville 7A glandless	--do--	1976	X

Table 1.--Upland cotton (*G. hirsutum*) cultivars and breeding stocks evaluated for field resistance to pink bollworm, Tempe and Phoenix, Ariz., 1974-79--Continued.

Cotton	Source	Year(s) tested	Reaction <sup>1</sup>
Deltapine SL glandless	W.R. Meredith, Jr., Miss.	1976	X
Coker 100A glandless	--do--	1976	X
Auburn M glandless	--do--	1976	X
Stardel glandless	--do--	1976	X
Lankart 57 glandless	--do--	1976	X
24-8 nectariless	--do--	1976	R
DES-haf 277	V.G. Meyer, Miss.	1976	X
DES-tom 277	--do--	1976	X
DES-haf 16	--do--	1975, 1976	X, X
DES-tom 16 ( <i>G. tomentosum</i> cytoplasm).	--do--	1975, 1976	R, X
DES-barb 16	--do--	1975	X
DES-arb 16	--do--	1975	X
DES-anom 16	--do--	1975	X
DES-herb 16	--do--	1975	X
BW 70-440C (High gossypol)	W.P. Sappenfield, Mo.	1976, 1977	R, X
BW 73-518	--do--	1978	X
BW 73-527	--do--	1978	X
BW 73-549	--do--	1978	X
BW 73-552	--do--	1978	X
8382A-2 nectariless	D.D. Davis, N. Mex.	1976	X
8383B-1 nectariless	--do--	1976	R
177-16 HG	J.A. Lee, N. Car.	1977	X
HL-1 (Cameroon)	L.M. Verhalen, Okla.	1975	S
BP 52/N63 (Uganda)	--do--	1975	S
108F (U.S.S.R.)	--do--	1975	X
HG9 (Chad)	--do--	1975	X
Albar 627 (Zambia)	--do--	1975	X
LSS (Pakistan)	--do--	1975	X
Cl211 (U.S.S.R.)	--do--	1975	X
Laxmi (India) (?)	--do--	1975	R
10 E (Greece) (Early)	--do--	1975, 1976	R, R
3279 (Bulgaria) (Early)	--do--	1975, 1976	R, X
6111 (Bulgaria) (Early)	--do--	1975, 1976	R, X
4521 (Bulgaria) (Early)	--do--	1975-77	R, R, S
Westburn 70	--do--	1976	X
Westburn M (Early)	--do--	1976-78	R, X, R
PD 6520 (Early)	T.W. Culp, S. Car.	1975, 1976	R, R
PD 695	--do--	1978	X
PD 8619	--do--	1978	X
UKA #1	A.C. Jackson, Tanzania	1977	X
SP-37 (Early)	L.S. Bird, Tex.	1975-78	R, R, X, R
CAMD-X-E-74-C	--do--	1976	X
ORS-13 (Okra-leaf, Early)	--do--	1976-79	R, X, R, R

Table 1.--Upland cotton (*G. hirsutum*) cultivars and breeding stocks evaluated for field resistance to pink bollworm, Tempe and Phoenix, Ariz., 1974-79--Continued.

Cotton	Source	Year(s) tested	Reaction <sup>1</sup>
ORS-59 (Okra-leaf, Early)	L.S. Bird, Tex.	1976	R
ORS 72-75	--do--	1977	X
ORS 75-75 (Okra-leaf, Early)	--do--	1977-79	X,R,R
ORMAR-S-2-75 (Okra-leaf, Early).	--do--	1977-79	R,R,R
ORH 77-75	--do--	1978	X
TM-1 Smooth	R.J. Kohel, Tex.	1974-76	S,X,X
TM-1 Pilose	--do--	1974, 1975	X,R
TM-1	--do--	1975	X
TM-1 Okra-leaf	--do--	1976	R
(T-86 Mut X DPL) G24:2 (?)	--do--	1976,1977	R,X
HG 6-1-N (High gossypol, nectariless).	M.J. Lukefahr, Tex.	1976-78	R,X,X
HG BR 8-N (High gossypol, nectariless).	--do--	1976	R
HGP-9-13	--do--	1978	X
HGDDS-N-1	G.A. Niles, Tex.	1978	X
407X1X4-27-5-70-2	--do--	1974	X
6M-10X634-10-71	--do--	1974	X
1209X407-35-68	--do--	1974	X
SP32XLDA-77-3-70-2	--do--	1974	X
407-27-2	--do--	1974	X
6-4X7X9-1-68	--do--	1974	X
6-19X(998X108)-6	--do--	1974	S
407-26	--do--	1974	S
(1209X407-38)DGAT-3-7-70 (Early).	--do--	1974-78	R,R,R,X,X
6-19X(108X45-5)-8	--do--	1974	X
6-19X5PHI-1-70-3	--do--	1974	X
1X6-56 (Early)	--do--	1974-78	R,R,R,X,R
D2LXDGAT-5-70-1	--do--	1974,1975	X,X
AET-5X(108XBr-2)-7-69 (antixenosis).	--do--	1974-79	R,R,R,R,R,R
AET Br 2-1 (?)	--do--	1977-79	R,R,X
AET Br 2-8 (?)	V.T. Walhood, Calif.	1977-79	R,X,X
Acala SS-126	--do--	1979	X
Acala SS-195	W.D. Fisher, Ariz.	1979	X
7209-30-104	--do--	1979	X
7203-14-104 (?)	R.R. Bridge, Miss.	1979	R
DES 4-30	--do--	1979	X
DES 4-44	--do--	1979	X
DES-4-22 (Early)	--do--	1979	R
Deltapine 70	E.C. Ewing, Jr. Miss.	1979	X

Table 1.--*Upland cotton (G. hirsutum) cultivars and breeding stocks evaluated for field resistance to pink bollworm, Tempe and Phoenix, Ariz., 1974-79--Continued.*

Cotton	Source	Year(s) tested	Reaction <sup>1</sup>
GH8-10-75	R. H. Dilday, Tex.	1979	X
D3-75 (Early)	--do--	1979	R
Stoneville 701N	C. W. Manning, Miss.	1979	X
Stoneville 887N	--do--	1979	X
Stoneville 506	--do--	1979	X
Tamcot CAMD-E (Early)	L. S. Bird, Tex.	1979	R
Gumbo Okra-leaf	J. E. Jones, La.	1979	X
Pronto Super Okra-leaf	--do--	1979	R

<sup>1</sup>S, seed damage caused by pink bollworm significantly higher than in the Deltapine or Stoneville check cultivar; X, seed damage not different from the cultivar; R, seed damage significantly lower than in the cultivar ( $P=0.05$ , based on 4 to 5 harvests, 4 to 5 replications).

<sup>2</sup>The probable reason for resistant reaction, if it is not evident by the designation of the breeding stock or cultivar, is shown in parentheses; unknown reason is shown as follows: (?).

Table 2.--*G. hirsutum* Texas race stocks<sup>1</sup> evaluated for resistance to pink bollworm, Phoenix, Ariz. (diet bioassays), and Isabela, Puerto Rico (field tests)

Cotton	Diet bioassay reaction <sup>2</sup>		Field tests	
	Carpel wall	Boll contents	Year(s) tested	Reaction <sup>3</sup>
Texas 2(T-2)	X	X	1976	S
T-3	X		1976	X
T-4			1977	X
T-6	X	X	1977	X
T-7	X	X	1977	R
T-8	X	X	1976-68	X,X,X
T-9	X	X		
T-10			1976	X
T-11	X	X		
T-15			1976	X
T-16	X	X	1976	X
T-17	X	X	1976,1978	X,R
T-20			1976	X
T-21	X	R	1977	X
T-22	X	X	1977	X
T-24			1978	X
T-25	R	R	1975-78	X,X,X,X
T-27	X	X		
T-30	X		1976	X
T-31	R	X	1977,1979	X,X
T-32	X	X		
T-33	X	X	1977,1978	X,X
T-34			1977	X
T-35	X	X	1977	X
T-36	X	X	1977	X
T-37		X	1977	X
T-38		X		
T-39	R	X	1977	X
T-40	X	R	1977	X
T-41		R	1977	X
T-43	X	X	1977	X
T-44	X	X	1976	S
T-45			1976	X
T-46			1977	X
T-48	X	X	1977,1979	X,X
T-49	X	X		
T-50	X	X	1978	X
T-51	X	X		
T-52			1977	X
T-53	R	X	1979	S
T-55	R	X	1975-79	X,R,R,X,R
T-56	X	X	1977	X



Table 2.--*G. hirsutum* Texas race stocks<sup>1</sup> evaluated for resistance to pink bollworm, Phoenix, Ariz. (diet bioassays), and Isabela, Puerto Rico (field tests)--Continued.

Cotton	Diet bioassay reaction <sup>2</sup>		Field tests	
	Carpel wall	Boll contents	Year(s) tested	Reaction <sup>3</sup>
T-57	X	X	1977	X
T-58		X	1976, 1977, 1979	R, R, X
T-59	X		1976	X
T-60			1976	X
T-61	X	X	1976	X
T-62	R	X	1977	X
T-63	X	X	1977	X
T-64	X	X	1977, 1978	X, X
T-65	X	R	1977, 1979	R, X
T-66			1976, 1979	X, X
T-67	X	X	1978	X
T-68	X	X	1975	X
T-69			1976	X
T-70			1975, 1977	S, X
T-71	X	X	1975	X
T-72	R	X	1977	X
T-73	X	X	1977	X
T-74	X	X		
T-75	X		1976	X
T-76			1975	X
T-77	X	X	1975	X
T-78	R	X	1976	X
T-79	X	X	1976	X
T-80			1975	X
T-83	X	X	1976	X
T-86	X	X	1975, 1978	X, X
T-87			1977	X
T-89	X	X	1975	X
T-90			1977	X
T-91			1975, 1978	X, S
T-93	X	R	1977	X
T-95			1976	X
T-96	X	X	1977	X
T-97			1978	S
T-98			1976	X
T-99			1977-79	R, X, X
T-100	X	X		
T-101	R	X	1977, 1978	X, X
T-102	X	R	1977, 1978	X, X
T-103	R		1976	X



Table 2.--*G. hirsutum* Texas race stocks<sup>1</sup> evaluated for resistance to pink bollworm, Phoenix, Ariz. (diet bioassays), and Isabela, Puerto Rico (field tests)--Continued.

Cotton	Diet bioassay reaction <sup>2</sup>		Field tests	
	Carpel wall	Boll contents	Year(s) tested	Reaction <sup>3</sup>
T-104	X	X	1977	X
T-105	X	X	1976	X
T-106	X		1976	X
T-107	X	X	1977	X
T-108	X	X	1976	X
T-109	X	X	1976	X
T-111		X		
T-112	X	X	1976	X
T-113	X	X	1976-78	X,X,X
T-114	X	X	1975	X
T-115			1975	X
T-116	X		1976	X
T-118	X	X	1975	X
T-119	X		1976	X
T-120			1976	X
T-121			1977	X
T-122			1976	X
T-123	X	X	1977	X
T-124			1975	X
T-126			1975	X
T-127			1975,1977,1978	R,X,S
T-128	X	X		
T-129	X	X		
T-139			1978	X
T-140	X	X	1976	X
T-142	X	X	1975,1978	R,S
T-143	X	X	1976	X
T-144	X	X		
T-145	X	X		
T-146	X	X		
T-148			1975	X
T-149			1975	X
T-150			1975	X
T-151	X		1976	X
T-152	X	X	1975	X
T-153	X	X	1976	X
T-154			1976	X
T-155	X		1975	X
T-156			1975	X
T-157			1977	X

Table 2.--*G. hirsutum* Texas race stocks<sup>1</sup> evaluated for resistance to pink bollworm, Phoenix, Ariz. (diet bioassays), and Isabela, Puerto Rico (field tests)--Continued.

Cotton	Diet bioassay reaction <sup>2</sup>		Field tests	
	Carpel wall	Boll contents	Year(s) tested	Reaction <sup>3</sup>
T-158			1976-79	X,R,R,X
T-160	X	X	1977,1979	R,X
T-161	X	X	1976	X
T-162			1975	X
T-163	X	X	1975	X
T-164	R	X	1975	X
T-165	X	X	1975	X
T-167	X	X	1977	X
T-168			1977,1979	R,X
T-169	X	R	1976	X
T-170			1976,1977,1979	X,R,X
T-171	X	X	1976	X
T-172			1975	X
T-173			1977	X
T-175	X	X	1977	R
T-176	X		1977,1979	R,R
T-177			1976	X
T-178			1977	X
T-179	X		1975	X
T-180			1975	X
T-181	R		1977-79	R,X,X
T-182	X		1976	X
T-183	X	X	1976	X
T-184	X			
T-185	R	X	1978	S
T-186			1975	X
T-187	X	X		
T-188	X	X		
T-192	X	X		
T-195			1976	X
T-196	X	X	1976	S
T-197	X	X	1975,1977	X,X
T-198	X		1977,1979	X,X
T-199	X	X	1976	X
T-200	X	X	1976	X
T-201			1976	X
T-202	X	X	1977	R
T-203	R	R	1977	X
T-204			1976	X
T-205			1976	X
T-206	\$	X	1975	X

Table 2.--*G. hirsutum* Texas race stocks<sup>1</sup> evaluated for resistance to pink bollworm, Phoenix, Ariz. (diet bioassays), and Isabela, Puerto Rico (field tests)--Continued.

Cotton	Diet bioassay reaction <sup>2</sup>		Field tests	
	Carpel wall	Boll contents	Year(s) tested	Reaction <sup>3</sup>
T-207	R	X	1979	X
T-208			1976	S
T-209			1976	X
T-212			1976	X
T-213	X	X	1975	X
T-214	X	X	1977, 1978	X, X
T-215			1976	X
T-216	R	X	1976	X
T-217	X	X	1976	X
T-218	X	X	1976	X
T-219	X	X	1976	X
T-220	X	R		
T-221	X	X	1976	X
T-222	X	X	1976	X
T-223			1975, 1976	X, X
T-224	X		1976	X
T-225	X	X	1976	X
T-226	R	X	1977, 1978	X, X,
T-227	X	X	1977	X
T-228	X	X	1976-79	R, R, X, X
T-229	X	X	1975	X
T-232	X	R	1976	X
T-233	X	X	1977	X
T-234			1975, 1977	X, X
T-235			1975, 1977	X, X
T-236	X	X	1976	X
T-237			1975	X
T-238	X	X		
T-239	X	X	1977	X
T-240	X		1976	X
T-241			1977	X
T-242	X	X	1977	X
T-243	X		1976, 1977	X, X
T-244	X	X	1978	X
T-245	R	X	1976, 1978, 1979	R, X, X
T-247	R	X	1976	X
T-248			1975	X
T-249			1977	X
T-250			1977	X
T-251	X	X	1979	X
T-253			1975	X

Table 2.--*G. hirsutum* Texas race stocks<sup>1</sup> evaluated for resistance to pink bollworm, Phoenix, Ariz. (diet bioassays), and Isabela, Puerto Rico (field tests)--Continued.

Cotton	Diet bioassay reaction <sup>2</sup>		Field tests	
	Carpel wall	Boll contents	Year(s) tested	Reaction <sup>3</sup>
T-254	X			
T-257	X	X	1975,1977	R,X
T-258	X		1976	X
T-265	X	X	1975	R
T-266	X	X		
T-267	X	X		
T-272			1975	X
T-273			1975,1977	R,X
T-293	X	R	1977	X
T-294	X	X	1977	X
T-295	X	X		
T-297	X	X		
T-301	X	X	1975	X
T-302			1975,1977	R,X
T-303			1975,1977	R,X
T-304	X	X	1976	X
T-306	X	R	1977	X
T-308	X	X		
T-311	X	X		
T-312	X	X		
T-314	X	X		
T-316	R		1977	R
T-318	X	X		
T-321			1975	X
T-322	X	X		
T-323			1976	X
T-324	X	X		
T-325	X	X		
T-326	X	X		
T-327	X	X		
T-328			1976	X
T-329			1975	X
T-330	X	X	1976-78	R,X,X
T-331			1975,1977	R,R
T-333	X	R	1976	X
T-335	R	X	1976	X
T-336	R	R	1977,1978	X,X
T-339	R	R	1977,1978	X,X
T-340	X		1976	X
T-342	R			
T-344	X	X	1976	X

Table 2.--*G. hirsutum* Texas race stocks<sup>1</sup> evaluated for resistance to pink bollworm, Phoenix, Ariz. (diet bioassays), and Isabela, Puerto Rico (field tests) --Continued.

Cotton	Diet bioassay reaction <sup>2</sup>		Field tests	
	Carpel wall	Boll contents	Year(s) tested	Reaction <sup>3</sup>
T-347	X	X		
T-375	X	X	1977	X
T-377		X	1977-79	R,X,X
T-378			1975,1977,1978	R,R,X
T-396	X	X		
T-401	X	X		
T-406	X	X		
T-408	X	X		
T-409	X	X		
T-419	X	X		
T-458	X	X		
T-459	X	X		
T-460	X	X	1976	X
T-461	X	X	1976	X
T-462	X	X		
T-463	X	X		
T-464			1975	X
T-466			1976	X
T-467			1975	X
T-469	R	X	1976	S
T-473	X	X		
T-479	X	X	1975	X
T-482			1977	X
T-488			1976	X
T-489			1977,1978	R,S
T-490	X	X	1977	X
T-492	X	R	1977	X
T-495			1976	X
T-497	X	X	1977,1978	R,S
T-498	X	X	1975	X
T-499	X	X		
T-500	X	X	1978	X
T-503	X	X	1977,1979	R,X
T-542	X	X		
T-570	X	X	1976-78	X,R,S
T-592	X	X		
T-595			1976	S
T-596	X	R	1975,1976	X,X
T-597	X	X	1975	X
T-600		X	1976	X
T-606			1975	X

Table 2.--*G. hirsutum* Texas race stocks<sup>1</sup> evaluated for resistance to pink bollworm, Phoenix, Ariz. (diet bioassays), and Isabela, Puerto Rico (field tests) --Continued.

Cotton	Diet bioassay reaction <sup>2</sup>		Field tests	
	Carpel wall	Boll contents	Year(s) tested	Reaction <sup>3</sup>
T-608	X	X		
T-609	X	X	1975	X
T-610	X	X	1976, 1977	R, R
T-611	X	X	1976	X
T-612	X	X	1976	X
T-615	X	X	1975	X
T-616	R	X	1976	X
T-619	X	X	1976	X
T-620	X		1976, 1979	R, X
T-622	X	R	1979	X
T-623			1976	X
T-625	X	X		
T-627			1976	X
T-633	X	X	1975	X
T-634	X	X	1976	X
T-635			1976, 1977, 1979	X, R, S
T-636	X	X	1976, 1979	R, X
T-627	X	X		
T-639	R	X	1979	X
T-640			1975	X
T-641	X	X	1976	X
T-642	X	X	1975	X
T-643	X	X	1975	X
T-644	X	X	1976	X
T-645	X		1976	X
T-646	R	X	175, 1976	X, X
T-647	X	X	1975	X
T-649	X	X	1975	X
T-650	X	X		
T-655	X	X		
T-657	R	X	1979	X
T-658	R	X	1979	X
T-664			1976	X
T-665	X	X	1976	X
T-668	R	X	1975, 1977, 1978	R, R, S
T-674	X	X		
T-675	X	X		
T-677	X	X	1975	X
T-679	X		1976-79	R, X, X, X
T-681	X	X		
T-682	R	X	1975, 1976	X, X

Table 2.--*G. hirsutum* Texas race stocks<sup>1</sup> evaluated for resistance to pink bollworm, Phoenix, Ariz. (diet bioassays), and Isabel, Puerto Rico (field tests) --Continued.

Cotton	Diet bioassay reaction <sup>2</sup>		Field tests	
	Carpel wall	Boll contents	Year(s) tested	Reaction <sup>3</sup>
T-683	X	X		
T-684	X	X	1976	X
T-685		X		
T-686	X	X		
T-687	X	X		
T-695	X	X		
T-701	X	X		
T-702			1976	X
T-703	R	X	1975, 1976	X, X
T-705	R	X	1976	X
T-707	X	X		
T-709	X	X		
T-711	R	X	1976	X
T-712		R		
T-717			1976	X
T-720	X	X		
T-725	X	X		
T-729	X			
T-738			1976	X
T-743	X	X	1976	X
T-749		X		
T-756	X	X		
T-757			1976	X
T-759	X	X		
T-760	X	X		
T-763	R	X	1977, 1978	R, S
T-764	X	R	1977, 1978	X, S
T-765	X			
T-766	X	X		
T-767		X		
T-769	X	X		
T-770	X	X		
T-771	X			
T-775	X	R	1977, 1978	X, X
T-786	X			
T-787	X			
T-790	X	X		
T-805	X	X		
T-931			1978	X
T-932			1978	X

Table 2.--*G. hirsutum* Texas race stocks<sup>1</sup> evaluated for resistance to pink bollworm, Phoenix, Ariz. (diet bioassays), and Isabela, Puerto Rico (field tests) --Continued.

Cotton	Diet bioassay reaction <sup>2</sup>		Field tests	
	Carpel wall	Boll contents	Year(s) tested	Reaction <sup>3</sup>
T-933			1978	X
T-937		R	1979	X
T-938	X			
T-941	X	X		
T-947	X	X		
T-950	X	X		
T-951	X			
T-952	X	X		
T-954	X	X		
T-955	R			
T-960	R		1977,1978	X,X
T-986	X			
T-1045		X		
T-1048	R	X		
T-1053	X	R	1977,1978	R,S
T-1054	X	X		
T-1055	X	X		
T-1057	X	X		
T-1067	X	X		
T-1105	X	X		
T-1125	X	R	1977,1978	X,X
T-1131	X	X		
T-1134	X	X		
T-1147	X			
T-1148	X	X		
T-1149	X			
T-1150		X		
T-1151	X	X		
T-1155	X	X		
T-1156	X			
T-1157		X		
T-1158	X	R	1977,1978	X,S
T-1159	X	X		
T-1161	X	X		
T-1164	X	X		
T-1166	X	X		
T-1167	X	X		
T-1174		X		
T-1175	X	X		
T-1176	X	X		
T-1177	R	X	1978,1979	X,X



Table 2.--*G. hirsutum* Texas race stocks<sup>1</sup> evaluated for resistance to pink bollworm, Phoenix, Ariz. (diet bioassays), and Isabela, Puerto Rico (field tests) --Continued.

Cotton	Diet bioassay reaction <sup>2</sup>		Field tests	
	Carpel wall	Boll contents	Year(s) tested	Reaction <sup>3</sup>
T-1179		X		
T-1180	X	R	1977-79	R,S,X
T-1182	R	X	1978,1979	X,X
T-1183	X			
T-1187	X	X		
T-1188	X	X		
T-1189	X	X		
T-1196		X		

<sup>1</sup>Source of Texas race stocks: S-77 southern regional project (P. A. Fryxell), Texas A&M University, College Station.

<sup>2</sup>S, growth of pink bollworm larvae faster or pupation higher than on diets of the Deltapine check; X, insect growth and development the same as the check; R, insect growth and development retarded (P=0.05; based on 4 replications of 25 larvae each). A blank space indicates no test.

<sup>3</sup>S, seed damage caused by pink bollworm significantly higher than in the Deltapine check cultivar; X, seed damage not different from the cultivar; R, seed damage significantly lower than in the cultivar (P=0.05; based on 4 replications, 2 to 5 harvests).

Table 3.--*G. hirsutum* Texas race stocks<sup>1</sup> evaluated for resistance to pink bollworm, Tempe, Ariz., 1974-79

Cotton	Year(s) tested	Reaction <sup>2</sup>
Texas 17(T-17)	1978	R
T-21	1974, 1975, 1978	X, X, X
T-31	1974-76, 1978	X, R, X, X
T-34	1974	S
T-35	1974	S
T-36	1974	X
T-38	1974	S
T-39	1974, 1975, 1978, 1979	X, X, R, R
T-40	1974, 1976, 1978, 1979	X, X, X, X
T-43	1974, 1975, 1978	X, X, X
T-53	1976, 1978, 1979	X, X, X
T-55	1975, 1976, 1978	R, S, X
T-56	1974, 1978	S, X
T-62	1974, 1978, 1979	X, X, S
T-63	1974, 1978	X, X
T-64	1974, 1978	S, X
T-65	1978	X
T-67	1974	S
T-72	1974, 1975	X, S
T-93	1974, 1975	X, X
T-101	1974-76, 1978	X, X, X, X
T-167	1974-76, 1978, 1979	X, X, X, R, R
T-203	1974, 1976, 1978	X, X, S
T-218	1976	R
T-226	1978	X
T-239	1974	X
T-243	1978	X
T-244	1974	X
T-245	1978	X
T-294	1974	S
T-375	1974	X
T-399	1974	X
T-408	1974	S
T-409	1974	X
T-616	1974	X
T-622	1978	X
T-705	1974, 1976, 1978, 1979	X, X, X, R
T-709	1974	X
T-712	1974, 1975	X, X
T-933	1979	X
T-1125	1978	X

<sup>1</sup>Source of Texas race stocks: S-77 southern regional project (P. A. Fryxell), Texas A&M University, College Station.

Table 3.--*G. hirsutum* Texas race stocks evaluated for resistance to pink bollworm, Tempe, Ariz., 1974-79--Continued.

<sup>2</sup>S, seed damage caused by pink bollworm significantly higher than in Deltapine check cultivar; X, seed damage not different from the cultivar; R, seed damage significantly lower in the cultivar ( $P=0.05$ ; based on 4 to 5 harvests, 4 to 5 replications).

Table 4.--*G. hirsutum* Texas race stocks<sup>1</sup> evaluated for antibiosis in a greenhouse where pink bollworm larvae were placed directly on the bolls

Cotton	Reaction <sup>2</sup>				
	Entrance holes/boll	Pupae/g boll wt	Pupal wt/g boll wt	Percent pupation	Days to pupation
Texas 21(T-21)					R
T-31				R	
T-39				R	R
T-40				R	R
T-53		R	R	R	
T-55			R	R	
T-62	R	R		R	
T-72		R			
T-102	R				
T-167				R	
T-196				R	
T-203					R
T-218		R			
T-226				R	
T-242				R	
T-243		R		R	
T-245	R	R		R	R
T-596	R			R	
T-622				R	
T-642		R		R	
T-703		R			R
T-705	R	R	R	R	R
T-711	R			R	
T-1053		R	R		
T-1180					R

<sup>1</sup>Source of Texas race stocks: S-77 southern regional project (P.A. Fryxell), Texas A & M University, College Station.

<sup>2</sup>R, growth and/or development of insect reduced significantly below the level observed in Deltapine 61, the commercial check. ( $P=0.05$ ; 4 replications, 100 bolls per replication.)

Table 5.--G. barbadense cultivars and breeding stocks evaluated for field resistance to pink bollworm, Tempe and Phoenix, Ariz., 1974-79

Cotton	Year(s) tested	Reaction <sup>1</sup>
Source: C. V. Feaster		
Coastland 9	1974	S
Giza 66	1974	X
Menoufi	1974	X
Sea Island	1974	X
Peruvian Pima	1974	X
S X P	1974	X
Pima 32	174	X
Giza 45	1974	X
Old Pima	1974	X
CB3084XPimaS-1F <sub>6</sub>	1974	X
(CB3081XPimaS-1) XPS-1	1974	X
Pima S-3	1974	X
Pima S-4 (check)	1974, 1979	X, X
Pima S-5 (check)	1975-79	X, X, X, X, X
Pima S-1	1974	X
Pima S-2	1974	X
Russian 9078	1974	X
Amsak	1974	X
Pima E-4	1974, 1975	X, S
Russian 5904	1974, 1975	X, X
Russian 5595	1974, 1975	X, S

Source: E. L. Turcotte

Pima Pilose	1974, 1975	X, R
Pima Okra-leaf	1974-76	R, X, X
Pima glandless	1974-78	X, R, R, R, R
Pima virescent	1974, 1975	X, X
Pima red	1974, 1975	S, S
Pima cream pollen	1975	S
Pima brown lint	1975	S
Pima cluster	1975	S
Pima brown lint (Lc <sub>1</sub> )	1975	X
Pima cream petal	1975	X
Pima Frego bract	1975	X
Pima monomeric (gl <sub>2</sub> Gl <sub>3</sub> )	1975	R
Pima monomeric (Gl <sub>2</sub> gl <sub>3</sub> )	1975	R
Pima dwarf	1975	R
Young's dwarf	1975	S

<sup>1</sup>S, seed damage caused by pink bollworm significantly higher than in the Pima S-4 or Pima S-5 check; X, seed damage not different from the cultivar; R, seed damage significantly lower than in the cultivar. (P=0.05; based on 4 to 5 harvests, 4 to 5 replications.)



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